Review of CAISO's Economic Evaluation Methodology for the Palo Verde Devers Line No.2 (PVD2)

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Background

Consortium for Electric Reliability Technology Solutions/Electric Power Group (CERTS/EPG) has carried out the following studies for the California Energy Commission:

1. Planning for California's Future Transmission Grid – Review of Transmission System, Strategic Benefits, Planning Issues and Policy Recommendations, October 2003.

2. California Electricity Generation and Transmission Interconnection Needs Under Alternative Scenarios, November 2003.

3. Economic Evaluation of Transmission Interconnection in a Restructured Market, June 2004.

Strategic Value of Transmission

Strategic benefits identified in CERTS/EPG report includes:

- Price stability and decreased market power for existing generators.
- Potential for increased reserve sharing and firm capacity purchases.
- Insurance against contingencies during abnormal system conditions.
- Environmental benefits.
- Reduction in construction of additional infrastructure such as gas pipelines.

Scope of Review of CAISO's Economic Evaluation for Palo Verde Devers No. 2[1]

- Review of CAISO Board Report on economic evaluation of PVD2
- Review of strategic benefits included in CAISO evaluation[2]
- Comparison of strategic benefits identified in CAISO evaluation with the ones recommended in a report prepared for CEC by EPG/CERTS
- Impact of using a social rate of discount on benefit-to-cost ratio

[1] A similar review will be carried out by CERTS/EPG on SCE's CPUC Filing for PVD2

[2] CERTS/EPG did not carryout any quantitative analysis to verify the magnitude of energy and other benefits reported in the CAISO report.

PVD2 Project Description

- 230 mile 500kV transmission line from Palo Verde area to Devers
- Rebuilding four 230kV transmission lines from Devers into Los Angeles Area
- Additional voltage support
- Projected on-line date: 2009
- Estimated capital costs: $620 Million
- Ability to import an additional 1,200 MW of power from Arizona

CAISO's Quantified Economic Benefits

- Energy cost savings
  - The difference between electricity production costs to serve the load with and without PVD2
- Operational benefit
  - Operational savings not captured in the production simulation model, such as generation unit commitment costs, minimum load cost compensation, re-dispatch of units to address real-time congestion
- Capacity benefit
  - Cost of capacity in Arizona lower than in California
- Loss Savings
  - Transmission losses to be lower as a result of PVD2. These losses are not captured in the DC Power Flow Model
- Emissions
  - Airborne emissions are not directly modeled in the production simulation model. However, there will be a reduction in NOx emissions due to PVD2

CAISO's Benefit Criteria

CAISO evaluated the benefit based on the following four perspectives:

1. **Societal** – the total WECC benefit including benefits to the consumers, producers, and transmission owners

2. **Modified Societal** – benefits to the producers from uncompetitive market conditions are excluded

3. **CAISO Ratepayer** (LMP only) – savings to CAISO ratepayers and assuming LMP throughout the WECC

4. **CAISO Ratepayer** (LMP + Contract Path) LMP market modified by the utilization of selected contractual paths between CAISO and Southwest region

CAISO Estimated Annual Energy Benefits for PVD2

(2008 Million $)

Perspective	2008		2013	
	Expected Value	Range	Expected Value	Range
Societal	$41	$4 - $200	$54	$20 - $200
Modified Societal	$61	$6 - $400	$81	$20 - $600
CAISO Ratepayer (LMP Only)	$39	($3) - $300	$56	($3) - $400
CAISO Ratepayer (LMP + Contract Path)	$110	$10 - $600	$200	$50 - $1,000

Benefit-to-Cost Ratios for PVD2
(2008 Millions $)

	Societal	Modified Societal	CA ISO Ratepayer (LMP Only)	CA ISO Ratepayer (LMP + Contract Path)
Levelized Benefits [1]	$91	$119	$84	$225
Levelized Capital & O&M Costs [2] [1]	$71	$71	$71	$71
B/C Ratio	1.3	1.7	1.2	3.2

(1) A discount rate of 7.16% is used for calculation of levelized benefits.
(2) Energy benefit is based on production simulation for 2008 and 2013 with the assumption that it is linearly increased from 2008 to 2013, and 1% annual escalation after 2013.

Comparison of Strategic Values

	CEC Report[1]	Original CA ISO[2]	CA ISO Board Report[3]
Price Stability Market Power	√	√	√
Potential for Increased Sharing and Firm Capacity Purchase	√		√
Insurance Against Contingencies During Abnormal System Conditions	√	√	√
Environmental Benefits	√		√ (NOx)
Reduction in Construction of Additional Infrastructure	√		

(1) Economic Evaluation of Transmission Interconnection in a Restructured Market prepared for CEC by EPG/CERTS June 2004.
(2) Presentations made by CAISO TEAM staff in April 2004.
(3) Board Report: Economic Evaluation of the PVD2 Line 2 prepared by CAISO Department of Market Analysis & Grid Planning Feb. 2005.

Recommendations on Strategic Values of PVD2

- There is need to refine the capacity value estimation and to capture the interaction between transmission and generation expansion
- Using the expected value for energy benefits, the insurance value of transmission expansion during abnormal system conditions is not fully captured
- Environmental benefits should include other benefits besides NOx reduction
- Decreasing California's need for additional infrastructure such as gas pipelines should be considered in estimating strategic values

Evaluation of PVD2 Using a Social Rate of Discount and Cost of Capital

- CAISO has evaluated the PVD2 benefits under both societal and CAISO ratepayer perspectives
- Under a societal perspective the social rate of discount should be used to calculate the present worth of benefits which is then compared with the capital cost of the project
- Under CAISO ratepayer perspective the discount rate based on weighted cost of capital should be used to calculate the annual levelized benefit which is then compared to the annual levelized cost. Real economic carrying charge could be used to convert capital cost to an equivalent stream of annual revenue requirement

Benefit-to-Cost Ratio for Societal and CAISO Ratepayer Perspective

(2008 Million $)

	Present Worth Using Social Rate of Discount[1]		Annual Levelized Using Cost of Capital and Carrying Charge[2]	
	Societal	Modified Societal	CA ISO Ratepayer (LMP Only)	CA ISO Ratepayer (LMP + Contract Path)
Energy Benefits	$1,072	$1,607	$57	$198
Other Benefits	$670	$670	$27	$27
Total Benefits	$1,742	$2,277	$84	$225
Capital and O&M Costs[3]	$721	$721	$71	$71
Benefit-to-Cost Ratio	2.42	3.16	1.2	3.2

(1) Social rate of discount is set to 5%.
(2) Discount rate for levelized benefits at 7.16% and carrying charge for levelized capital cost at 10.43%.
(3) Present worth of O&M is calculated at 0.25 of capital cost escalating at 3% and than discounted at social rate of discount.

Summary Results

- Based on the magnitude of the benefits calculated by CAISO, the benefit-to-cost ratio of PVD2 is higher than 1.0 under all four perspectives
- Some of the strategic value such as insurance value during abnormal system conditions, environmental benefits besides NOx reduction and decrease in California's need for additional infrastructure such as gas pipelines are not fully captured in CAISO report
- The use of a social rate of discount to calculate the present worth of PVD2 benefits under societal perspective will more than double the benefit-to-cost ratio of the project compared to using weighted cost of capital to discount the future benefits